

# Assessment of Neglected and Under-Utilized Crop Species of African Horned Melon in Zambia

Prof. Gideon C. Mwanza\*, Prof. Julius Siwale, Prof. Edward Nakasala, Dr. Andrew Phiri, Mr. Bernard Jere, Ray Banda, Mr. Joseph Mulaisho, Mr. Gideon Mwanza, Ms. Mary Mwanza, Doreen Mushele & Dr. Esther Mfoya

School of Agriculture, Gideon Robert University, Zambia.

Corresponding Author (Prof. Gideon C. Mwanza) - vc@gideonrobertuniversity.com\*



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## ABSTRACT

There is an increasing interest in neglected and under-utilized crop species (NUS) throughout the world, reflecting a growing trend within agriculture to identify and develop new crops for export and domestic markets. Interest in NUS stems from a variety of factors, including their contribution to agricultural diversification and better use of land, their economic potential and the opportunities they provide for diet diversification. The main objective was to assess the economic and nutritional value of neglected and utilized crop species of African horned melon in Zambia.

The study used the qualitative research design and descriptive, using desk review to collect secondary data from various literature on neglected and under-utilized crops species of African horned melon.

In conclusion, the findings reveal that the African horned melon has nutritional value consisting numerous vitamins and antioxidants which are beneficial to health living of humans and will contribute and broaden food diversity and nutritional among rural and urban communities of Zambia. The crop will promote healthy living among Zambian citizen to overcome malnutrition and obesity. Further, African horned melon is a climate change crop that will enhancing rural resiliency and climate smart agriculture activities in many areas. Communities must be trained and have knowledge experience of farmer-to-farmer capacity building in rural areas of Zambia.

**Keywords:** Neglected crop species; Nutrition; Food insecurity; African horned melon; Zambia.

## Introduction

African horned melon (*Cucumis metuliferus*) is one of the neglected crop species from Cucurbitaceae family with recognized nutritional and medicinal properties especially in African countries. Sustainable agriculture productivity is hampered by over-dependency on major crops such as maize, soya beans, etc., and neglected and under-utilized crops species are given little attention by policy makers, researchers and agronomists/plant breeders in Zambia. African horned melon is one of the neglected and under-utilized crop species in Zambia. Under-utilized crop species crops (also known as neglected, minor, orphan, promising or little used) are mostly wild or semi domesticated species adapted to local environment. These crops are used as traditional foods for centuries but become increasingly neglected when more productive crops become available in farming system.

This review paper describes the morphology, agronomic and nutritional potential regarding African horned melon is understood, therefore to conserve the biodiversity of this crop, there is need to promote its domestication, production and consumption.

## Problem Statement

In Zambia, African horned melon crop has been in existence from the time memorial, it has been neglected, little is known about this indigenous African melon cultivated and wild crop species, that have potential as food and cash crop, but have typically been over looked by scientists, policy makers and the world at large. This crop species has a potential to help boost food security, reduce malnutrition, foster rural development and create sustainable land care in Zambia. Currently, the country is experiencing food insecurity, poor nutrition, and impacts of climate

changes effects affecting rural communities, the government has broad development plans to alleviate poverty, hunger, malnutrition for its citizens, but it cannot meet the needs of large population of 19 million Zambians.

In addition, the main reasons why this African horned melon is under exploited in this country is that knowledge of the crop was passed on from mother to mother in the time memorial, it is not well known among urban communities and not documented, there is little capacity to process and market them. Further they do not get much attention from Zambian researchers. From the companies' point of view, they are regarded as to have no monetary value as commercial crop. In this regard, the proposed project will focus to evaluate its economic potential to enhance food production, nutrition and environmental sustainability as it is a drought tolerant crop.



*Cucumis metuliferus* (local name *Chitunguza* in Zambia) kiwano (local name in Kenya)

## Literature Review

The vision of Zambia is to be a prosperous middle-income nation by 2030 but the progress report on Zambia Sustainable Development Goals shows that extreme poverty is still high in rural areas. It is four times higher in rural Zambia (57.7%) than in urban centres (13.1%), with Luapula (64.9%), North -western (64%), and Eastern Province (58.7%) being the poorest provinces due to limited physical infrastructure (UNDP, 2013). The majority of the people still live-in rural areas of Zambia.

Smallholder farmers in Zambia are facing unprecedented challenges to deal with changing climates and other agoclimatic factors caused by biotic and abiotic stresses. The fruit has been around for years in Zambia, it is a dry or semi dry arid fruit that is native to Africa's dry areas due to harsh climatic circumstances, it has become the traditional African fruits that keeps Africans hydrated during dry seasons. It can be consumed as snack in between meals. It can be used to add flavor to salads. Further, the horned melon is packed with anti-oxidant, its seed has strong antioxidant content that protects blood arteries and neurons while also neutralizing free radicals in the body. Its antioxidant qualities help to flush out chemicals from the body; it helps to protect humans from variety of serious illness including cancer and heart diseases. It contains vitamins C, one of the many essential nutrients found in the horned melon. It aids in collagen formation and restoration of injured skin and organ tissues protect cells from damage, bone strength, helps digestion, helps eyes, stress relief, improve brain function, strengthening muscles, reduces risks of obesity, cures iron deficiency and keeps heart happy.

*Cucumis metuliferus* commonly known as *African Horned melon*, *horned melon*, *Spike melon*, *Jelly melon* are related to fruit like musk melons and cucumbers, also known as *kiwano* in Kenya. They belong to the kingdom Plantae, order Curcubitales, family Cucurbitaceae, genus *Cucumis* and species name *Cucumis metuliferus* and it is an annual creeping plant or vine belonging to cucumber and melon, family **Cucurbitaceae**. Its fruits have horn like spines. It is an annual vine that produces an orange-colored fruit that has rough, spiky outer skin, hence the name "Horned melon". It is found in South Africa, Namibia, Botswana, Angola, Mozambique and Zambia. *Vitunguza* locally known in Zambia is a traditional food plant in Africa. Along with the Gemsbok cucumber (*Acanthosicyos naudinianus*) and Tsamma (Citron melon) it is one of the few sources of water during the dry season in the Kalahari Desert. In Northern Zimbabwe, it is called *gaka* or *gakachika*, and is primarily used as a snack or salad, and rarely for decoration. It can be eaten at any stage of ripening. In Kenya it is called *kiwano*. The African horned melon which is also known as *kiwano* is a fruit from the central and southern regions of Africa. It is popular snack and found in Australia, New Zealand and parts of USA. It grows in the field and is very quick to take over other crops species, classifying it as a weed in some parts of the world.

The African horned melon has a long history, being an integral part of life in the Kalahari Desert where water is scarce. Due to its long shelf life, the fruit can be consumed months after harvest. It's also an excellent source of vital vitamins and minerals such as vitamins A and C and calcium. When hollowed out, *kiwano* can be used for decorative purposes as well due to the horns on the skin that give it a sort of natural stability.

Furthermore, the fruit 's taste has been compared to a combination of banana and passion fruit taste, cucumber and a combination of banana, cucumber and lime. A small amount of salt or sugar can increase the flavor but the seed



content can make eating the fruit less convenient than many common fruits. Some also eat the peel, which is very rich in vitamin C and dietary fiber.

Strategies to attain this vision include commercialization of small-scale agriculture including promotion of under exploited crop species, processing, market linkages, irrigation, crop diversification, quality inputs, rural resiliency and adaptation strategies to climate change, promoting collaboration among players such as the development sector, communities and the private sector, among others (*SNDP*). These strategies are appropriate in that 80% of Zambia's population (about 19 million people) is dependent on agriculture for their livelihoods. Crops that have been forgotten over the last century are being rediscovered. Scientists and policymakers are now beginning to recognize the value of so-called 'orphan' crops, affirming what local communities have known for generations. The African Yam Bean, the Desert Date and Ber (a stocky tree with a vitamin-rich berry) exemplifies the paradigm. Though not traded internationally, they are uniquely adapted to their local environments and play a vital role in supporting diverse diets in Sub-Saharan Africa (FAO, 2017). Also known as 'neglected and underutilized', 'minor' or 'promising' crops, orphan crops have been overlooked by research, extension services and policy makers; governments rarely allocate resources for their promotion and development. That results in farmers planting them less often, reduced access to high quality seeds, and loss of traditional knowledge.

Neglected and underutilized species have been overshadowed by those in greater demand. Of the 30,000 edible plant species, a mere 30 are used to feed the world. Yet these neglected and underutilized crops can help to increase the diversification of food production, adding new species to our diets that can result in better supply of particular nutrients, i.e., essential amino acids, fiber, proteins.

In addition to diversifying nutritional intake, neglected and underutilized crops provide economic and environmental benefits. Farmers can grow them on their own, as part of crop rotation systems or inter-plant them with other crops, protecting and enhancing agro-biodiversity at the field level. Having a bigger number of species to choose in a crop rotation system allows farmers to have a more sustainable production system. By changing species in a crop rotation system, the cycle of some pests and diseases is disrupted and probabilities of infestations are reduced.

## Methodology

This chapter gives a detailed description of the methods that were used to carry out the study. It comprised the research design appropriate for the study followed by the target population from which possible findings from the study were generalized, the sample size and sampling techniques, which were expected to give a representative inference of the population on all major variables. The chapter would then identify and describe the research instruments that were used in the study, stating their validity and reliability tests. The section would conclude by identifying the methods that would be used to analyse the data. This research adopts a research design that is descriptive in nature. Mugenda (2008) noted that a research design that is descriptive helps to determine and report things naturally and attempts to present issues as feasible behavior, attitudes, ideals and characteristics. The research methodology that is used in this study, the secondary research data collection was used in order to serve time and effort in collecting secondary data. The study revealed various literature on the research topic. Data for

research was found in various sources such as articles, journals, reports (both published and unpublished) bulletins, libraries, and key informants from government and non-governmental organizations. Simple random sampling technique was adopted in the study about neglected and underutilized crop species of African horned melon. All the gathered secondary data, analyzed and determine that all questions in the specific NUS were addressed. These gathered secondary data is from reliable sources. These methods of desk research have been adopted because it is the most important kinds of research is inexpensive, make well informed judgements and is also useful in the narrowing the study. This method has been adopted also saves time and proving to be effective. Further, data from the internet to acquire secondary data is one of the most common methods, secondary data is easily accessible over the internet and it is free.

### Findings and Analysis

According to report by A. Hill (2019); revealed that there are benefits of horned melon, contains a variety of essential nutrients which horned melon boasts an array of vitamins and minerals, many of which play a significant role in its ability to positively impact health. Furthermore, a single horned melon (209 grams) provides the following nutrients;

- Calories – 92 grams
- Carbohydrates (carbs) – 16 grams
- Proteins – 3.7 grams
- Fat – 2.6 grams
- Vitamin C – 18% of the Reference Daily Intake (RDI)
- Vitamin A – 6% of the RDI
- Vitamins B6 – 7% of the RDI
- Magnesium – 21% of the RDI
- Iron – 13% of the RDI
- Phosphorus – 8% of the RDI
- Calcium – 3% of the RDI

It is consist mainly of water and relatively low in calories, carbs and fats. The report further reveals that 16% of its calories come from protein which is relatively high compared to other fruits. This unique nutrient distribution makes horned melon suitable for a variety of diet plans. In horned melon fruits contains many vitamins and minerals that are essential to optimal health.

According to Brandi Marcene report (October, 2021) findings reveal that Kiwano Melon or Horned Melon brings about benefits includes improving digestion, neutralizing free radicals, preventing cancer, slowing down the aging process, alleviating stress, improving visibility and strengthening bones. Other benefits include promoting cognitive function, strengthening hair follicles, enhancing the skin, maintaining heart health, promoting brain

health, treating iron deficiency, curing diabetes, aiding recovery from heat stroke, strengthening muscle, and decreasing the risk of obesity. In addition, Brandi findings reveals that the kiwano can become a fresh addition to your salads. The taste of the fruit is similar to bananas and passionfruit. The peel of the melon contains essential nutrients, organic compounds, vitamins, and minerals. This reason is why the World Health Organization (WHO) considered it an essential fruit for fighting malnutrition and treating illnesses. The following are known benefits of this horned melon:

### **1. Full of Antioxidants**

The high antioxidant content (a-tocopherol and y-tocopherol) in kiwano keep the blood vessels and nerves healthy as well as neutralize the free radicals in the body. It flushes out carcinogenic substances from the body, thanks to its antioxidant properties. The nutrients in this fruit protect you from various critical illnesses, including cancer and heart diseases.

### **2. Improves Digestion**

Chitunguza (Kiwano) is loaded with dietary fibers that improve the digestion process. The basic function of fiber is that it facilitates healthy digestion. It prevents serious medical conditions, such as colon cancer and gastric ulcers. The gelatinous nature of the fruit reduces constipation and cleans the urinary tract.

### **3. Reduces Pre-Mature Aging**

Horned Melon offers many crucial elements to the body, including vitamin C. Kiwano helps in the production of collagen and repairs damaged skin and organ tissues. The fruit shields cells from injury, toxins and waste products that may lead to the development of many aging disorders. Moreover, regular consumption of kiwano prevents the early symptoms of aging, such as scars, blemishes, and spots.

### **4. Alleviates Stress**

The organic constituent of kiwano helps to regulate the stress hormones, such as adrenaline. People who suffer from chronic anxiety can consume kiwano to feel relaxed.

### **5. Maintain Metabolic Process**

Since the process of metabolism breaks down the food into a simpler compound, the body needs some necessary elements to perform its functions properly. Kiwano provides a sufficient amount of zinc required for the insulin discharge and normal carbohydrate metabolic process. It also produces blood cells and helps repair wounds.

### **6. Improve Visibility**

Horned Melon contains a high amount of vitamin A that helps to improve your eyesight. Vitamin A is a kind of carotenoid with antioxidant properties. This antioxidant inhibits macular degeneration and also eliminates the free radicals that lead to eye irritation and various eye problems, such as cataracts.

### **7. Strengthens Your Bones**

Horned Melon is rich in various minerals, such as zinc, calcium and other minerals. The minerals help in the development and growth of bones. Due to its calcium storage capability, it helps to treat bone-related issues and conditions, such as osteoporosis.

## **8. Cognitive Function**

The vitamin E in Kiwano improves brain function and slows down neurological disorders, such as Alzheimer's disease and dementia. The high level of tocopherol boosts the cognitive function and also helps facilitate cognitive function and keeps the mind fresh.

## **9. Strengthen Hair Follicles**

The nutritive element of the kiwano fruit can improve your hair strength and make it fertile. The only catch is that you have to consume it on a daily basis.

## **10. Skin Care Antioxidant**

The organic compounds and high level of antioxidants in kiwano prevents blemishes and spots on the skin. Kiwano contains citric acid, which adds a glow to your skin and helps you look younger.

## **11. Maintains Heart Health**

Kiwano seeds contain linoleic acid that strengthens the heart muscles and helps improve your overall cardiovascular health. The unsaturated omega six fatty acids help people dealing with cardiac issues to manage their condition. Plus, you can consume kiwano to balance your cholesterol levels and prevent heart complications.

## **12. Brain Therapy**

Kiwano is rich in sodium, an element known to enhance brain function. You can add extra salt to your meals by consuming more kiwano.

## **13. Treats Iron Deficiency**

This is good news for patients who are suffering from anemia: they can restore their hemoglobin levels by consuming more kiwano. Kiwano contains a high level of iron and other essential nutrients that your body needs. Experts describe it as a 'natural drug' for treating anemia.

## **14. Cure Diabetes**

If you are looking for the perfect fruit for diabetics, Chitunguza (kiwano) is the best option as it contains a rich amount of magnesium that helps you manage your blood sugar.

## **15. Aids Recovery from Heat Stroke**

The global warming phenomenon means that the average temperatures around the world are on the rise. The risk of a heat stroke and a sun stroke is higher than ever. Luckily for you, kiwano can help you recover from a heat or sun stroke. The fruit is rich in sodium and water, ensuring you stay hydrated in case you have a stroke.

## **16. Strengthens Your Muscles**

Horned Melon is rich in potassium that makes this fruit essential for your muscles. The high vitamin D content also helps in better absorption of calcium in the body, thus improving your muscular strength.

## **17. Helps with Cancer Treatment**

The high antioxidant content of Horned Melon prevents the formation of carcinogenic substances and free radicals in the body.

## 18. Decreases the Risk of Obesity

Fitness is an important factor when it comes to your overall health and wellness, and hence few fruits are better than kiwano melon, which has 90% water content. The water content of the fruit helps remove harmful substances from your body. The best part is that you don't have to limit your intake of the kiwano melon.

### Researchers Thoughts

Behind its unusual appearance, kiwano melons (Chitunguza) are loaded with a lot of beneficial qualities. If one wishes to stay fresh and energetic, one must include kiwano in the diet. It's not only bringing taste to your cuisine but also decorate your food. As mentioned, you can consume as much of this fruit as you want. You don't have to limit yourself to certain portions. Few other fruits offer as many health benefits as kiwano melon, and therefore you should definitely consider making this fruit a part of your daily diet.

### Conclusion and Recommendations

In conclusion, conflict, climate variability and extremes, and economic slowdowns and down turns are key drivers of food insecurity in Africa. The production and promotion of African horned melon is significant to address food insecurity and nutrition security in Africa, in particular in Zambia. The crop has potential to help overcome malnutrition, boost food security, foster rural development and create sustainable land care. To attain a long-term strategy for food security and nutrition in Zambia, farmers and gardeners must adopt production, process and marketing of African horned melon in order to eliminate food insecurity, boost agricultural output and improve standards of living of rural population by increasing production and consumption of horned melon.

With regard to the research reviews, it is recommended to increase production, processing and marketing of African horned melon, carry out on farm seed multiplication and morphology characterization of African horned melon. In the long term, the country through the Ministry of Agriculture should promote utilization of this genetic diversity of this indigenous crop species owing the nutritional value of this neglected crop species through enhanced agriculture research and development of under exploited crop species. Further, the country needs to foster an increase in the production of neglected and utilization of indigenous along entire production value chain from farmers' fields to processing and marketing, this can be achieved through intensified on farm seed multiplication, provision of training to farmers' who in turn become out grower farmers. The crop will foster health living and sustained long life among Zambian citizens.

### **Declarations**

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#### **Competing Interests Statement**

The authors declare the total absence of conflicts of interest, both during the conduct of the study and during the written drafting of this work.

#### **Consent for Publication**

The authors declare that they consented to the publication of this research work.



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